Stellar Forensics with SNe & GRBs: Deciphering the size & metallicity of their massive progenitors

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Massive stars die violently. Their explosive demise gives rise to brilliant fireworks that constitute supernovae and long GRBs, and that are seen over cosmological distances. By interpreting their emission and probing their environment, we get insights into the size, make-up, mass loss history and metallicity of their massive progenitor stars that are situated at extragalactic distances.

I will present extensive X-ray, optical and NIR data on SN 2008D which was discovered serendipitously with the NASA Swift satellite via its X-ray emission from shock breakout. It is a supernova of Type Ib, that is, a core-collapse supernova whose massive stellar progenitor had been been stripped of most if not all of its outermost hydrogen layer, but had retained its next-inner helium layer, before explosion. I will discuss the significance of this supernova, the derived size of its Wolf-Rayet progenitor, what it tells us about the explosive demise of massive stars, and its implications for the supernova-GRB connection. Furthermore, I will present observational results that confirm low metallicity as a key player in determining whether some massive stars die as GRB-SN or as an ordinary SN without a GRB. I show that the oxygen abundances at the SN-GRB sites are systematically lower than those found near ordinary broad-lined SN Ic, at a cut-off value of $0.3-0.5\ Z_{solar}$.